

# REPORT DOCUMENTATION PAGE

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MEMORANDUM FOR PRS (In-House Publication)

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10 September 2002

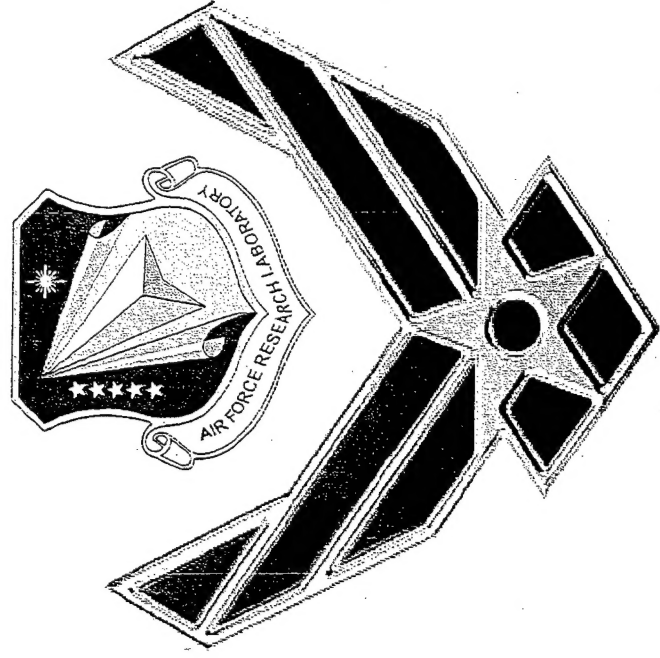
SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-VG-2002-219**  
C.T. Liu (PRSM) et al., "Investigating the Effects of Pressure on the Near Tip Behavior and Crack  
Growth in a Particulate Composite Material" (viewgraphs only)

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**Int'l Conf on Damage & Fracture Mechanics 2002**  
**(Maui, HI, 15-17 October 2002) (Deadline: 11-Oct-02)**

**(Statement A)**

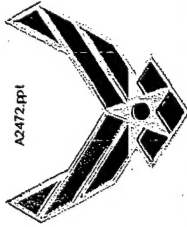
# Investigating the Effects of Pressure on the near Tip Behavior and Crack Growth in a Particulate Composite Material



C.T.Liu<sup>1</sup> & M. Tam<sup>2</sup>

<sup>1</sup> Propulsion Directorate, U.S. Air Force  
Research Laboratory, U.S.A.

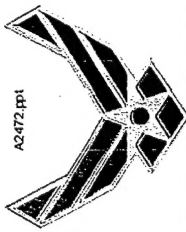
<sup>2</sup> The Aerospace Co. U.S.A.



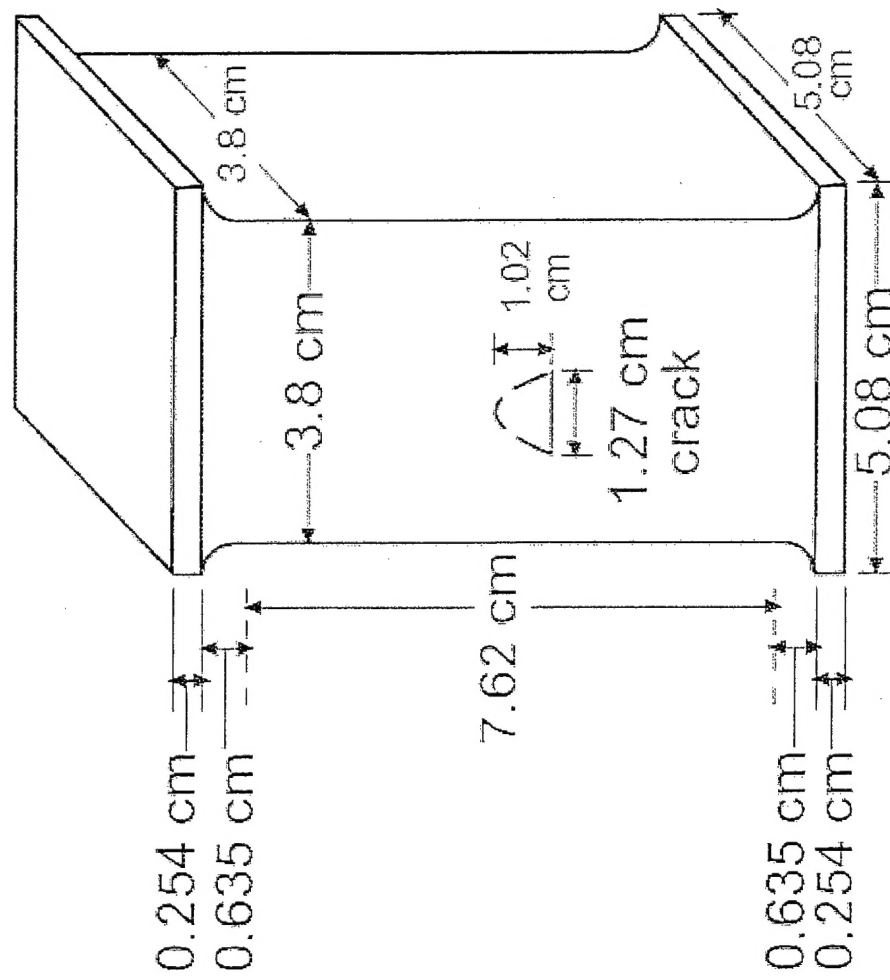
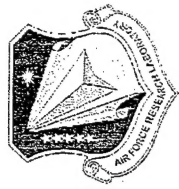
# Objectives

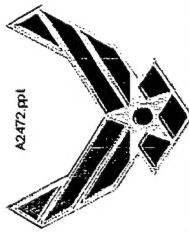


- Investigate the Effects of Confining Pressure and Loading History on the Near Tip Behavior and Crack Growth in a Particulate Composite Material.
- Confining Pressure:
  - Ambient and 8697 KPa
- Loading History:
  - Constant Strain Rate (5.8 cm/cm/min)
  - Constant Strain (18%)

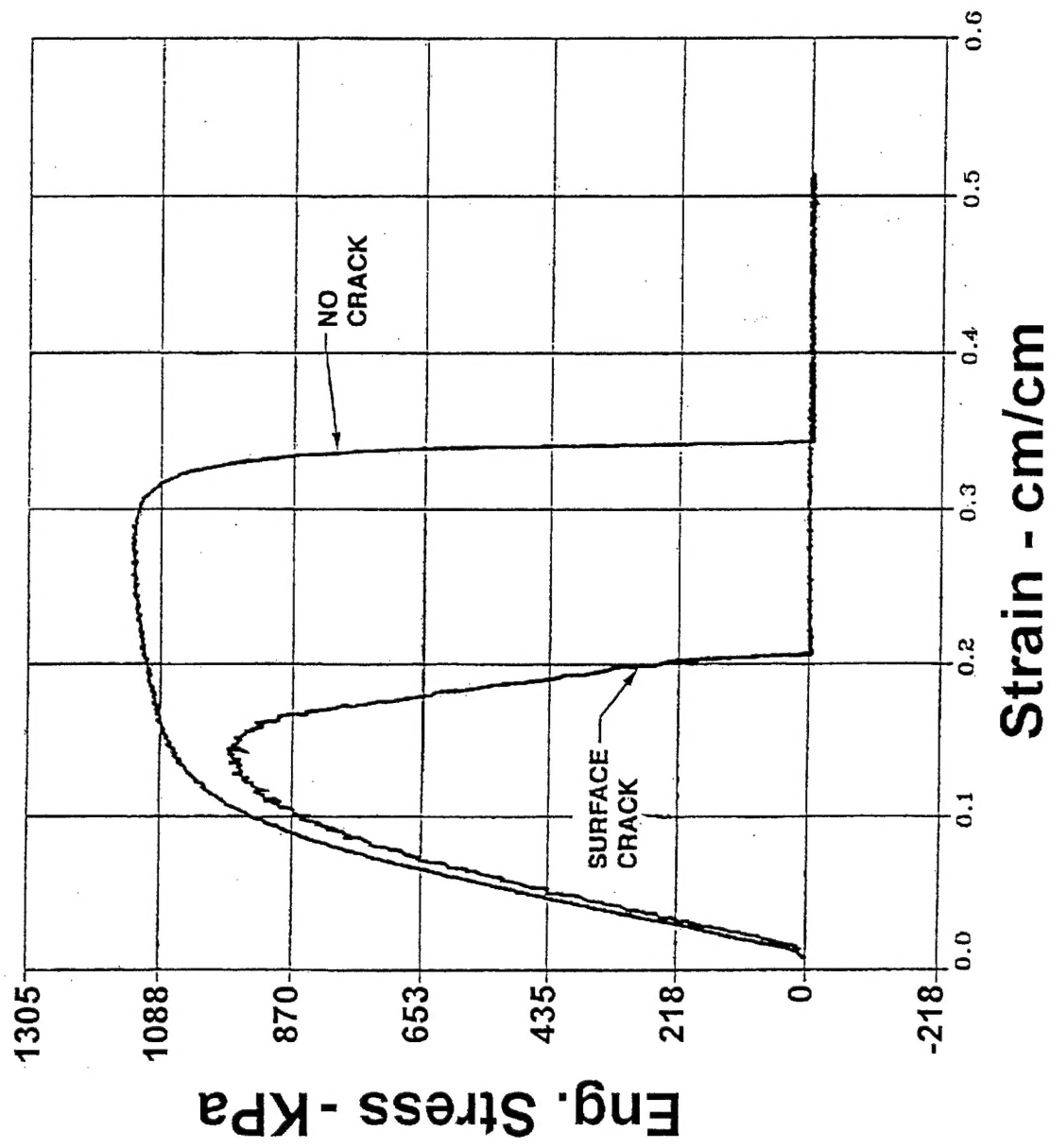
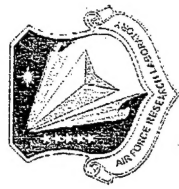


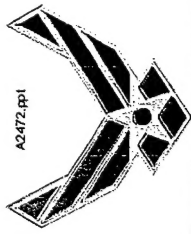
# Specimen Geometry



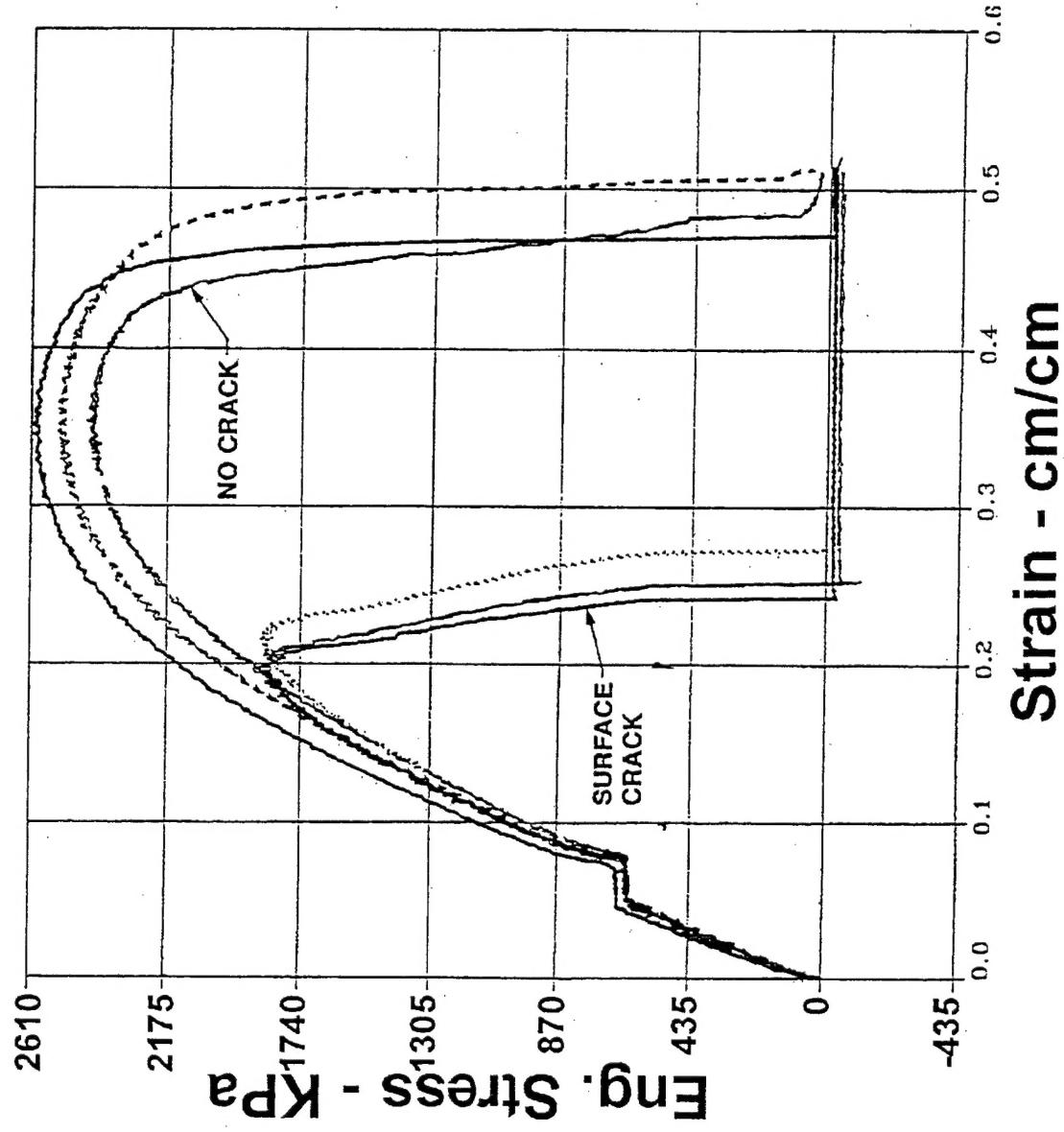


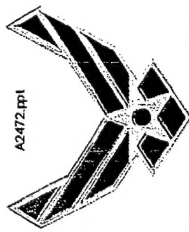
# Engineering Stress Vs. Strain (Ambient Pressure)



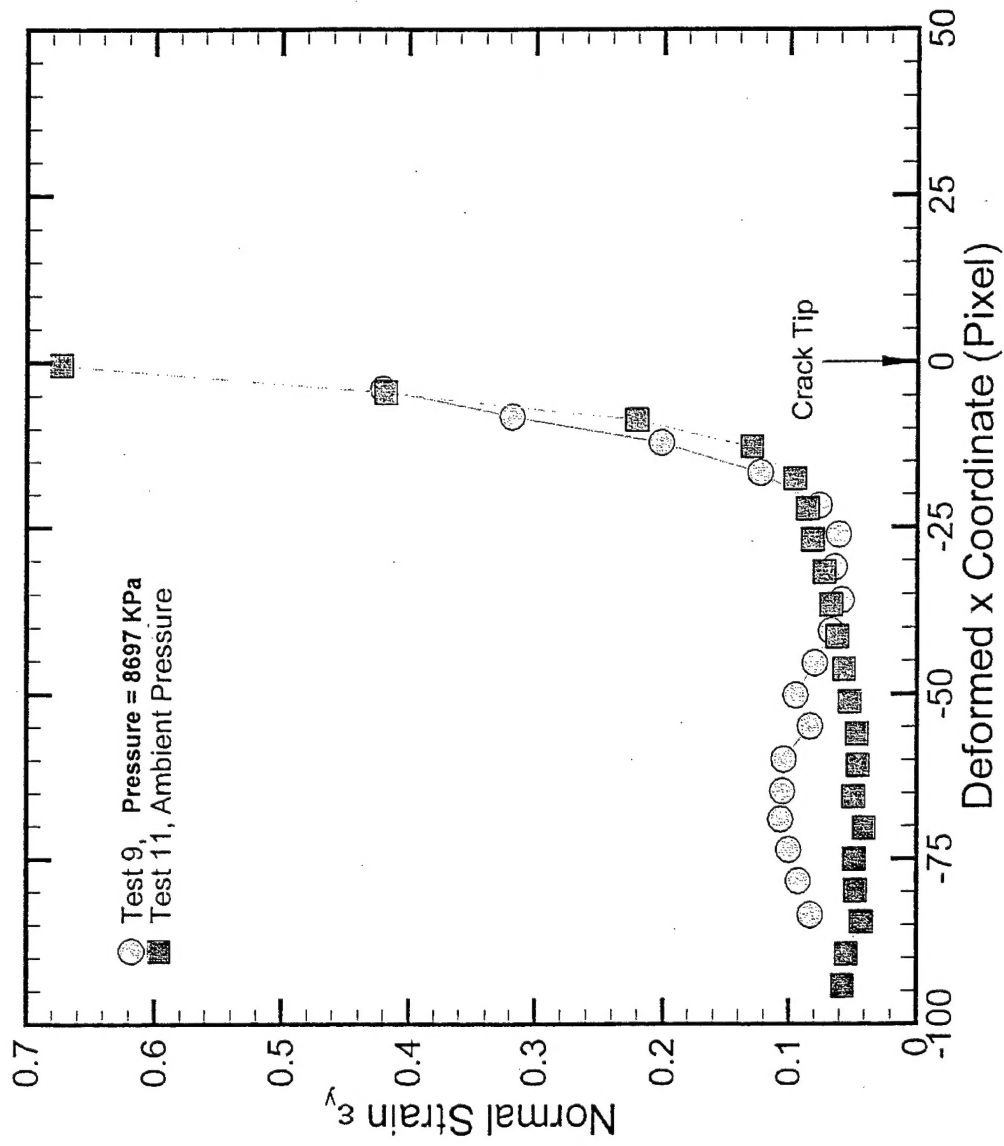
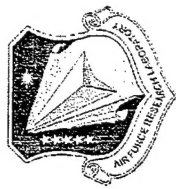


# Engineering Stress Vs. Strain (8697 Kpa Pressure)

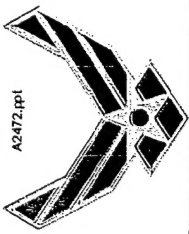




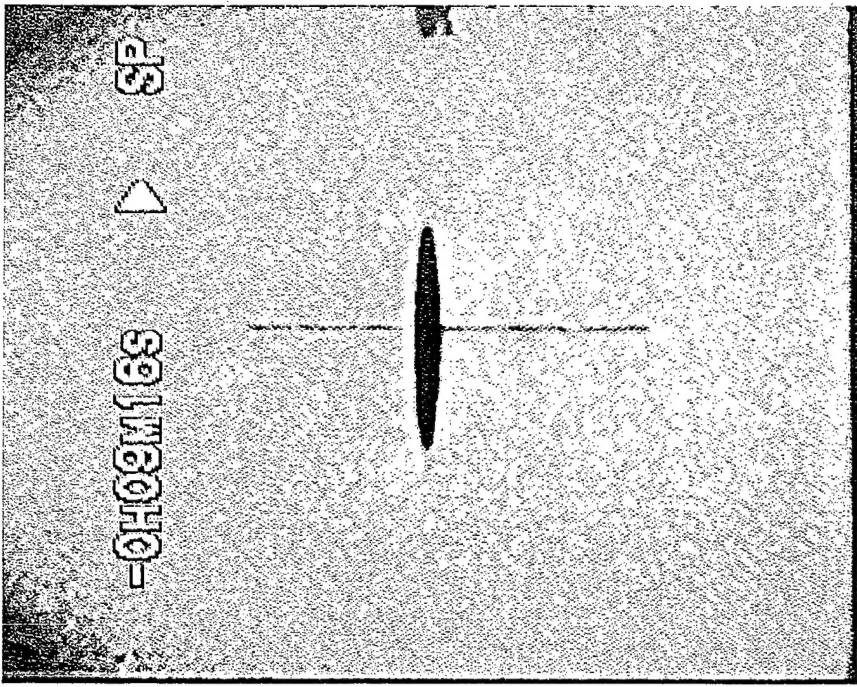
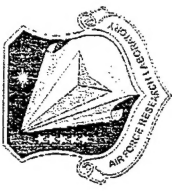
# Normal Strain Distribution Ahead of the Crack Tip at the Onset of Crack Growth



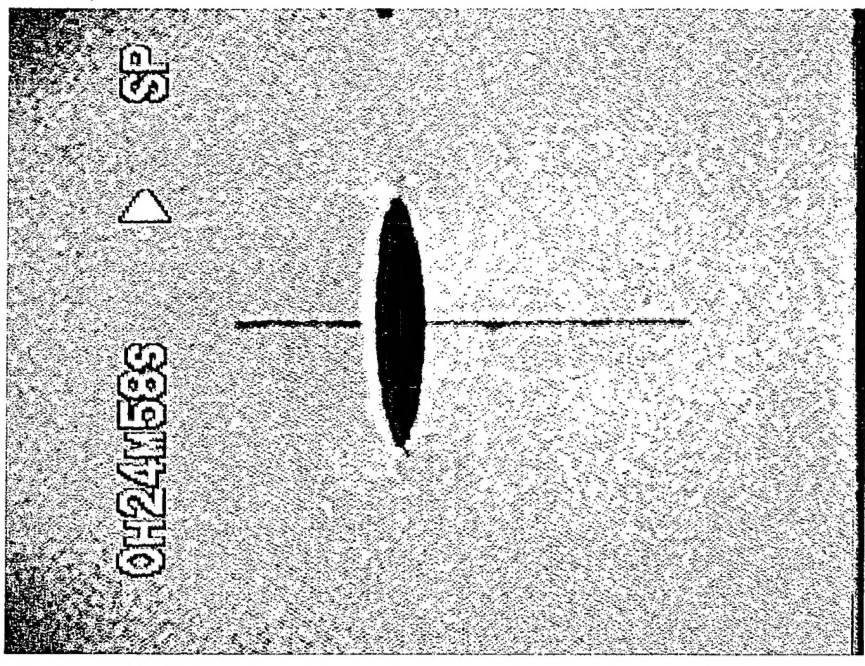




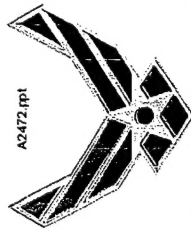
# Crack Profiles at the Onset of Crack Growth



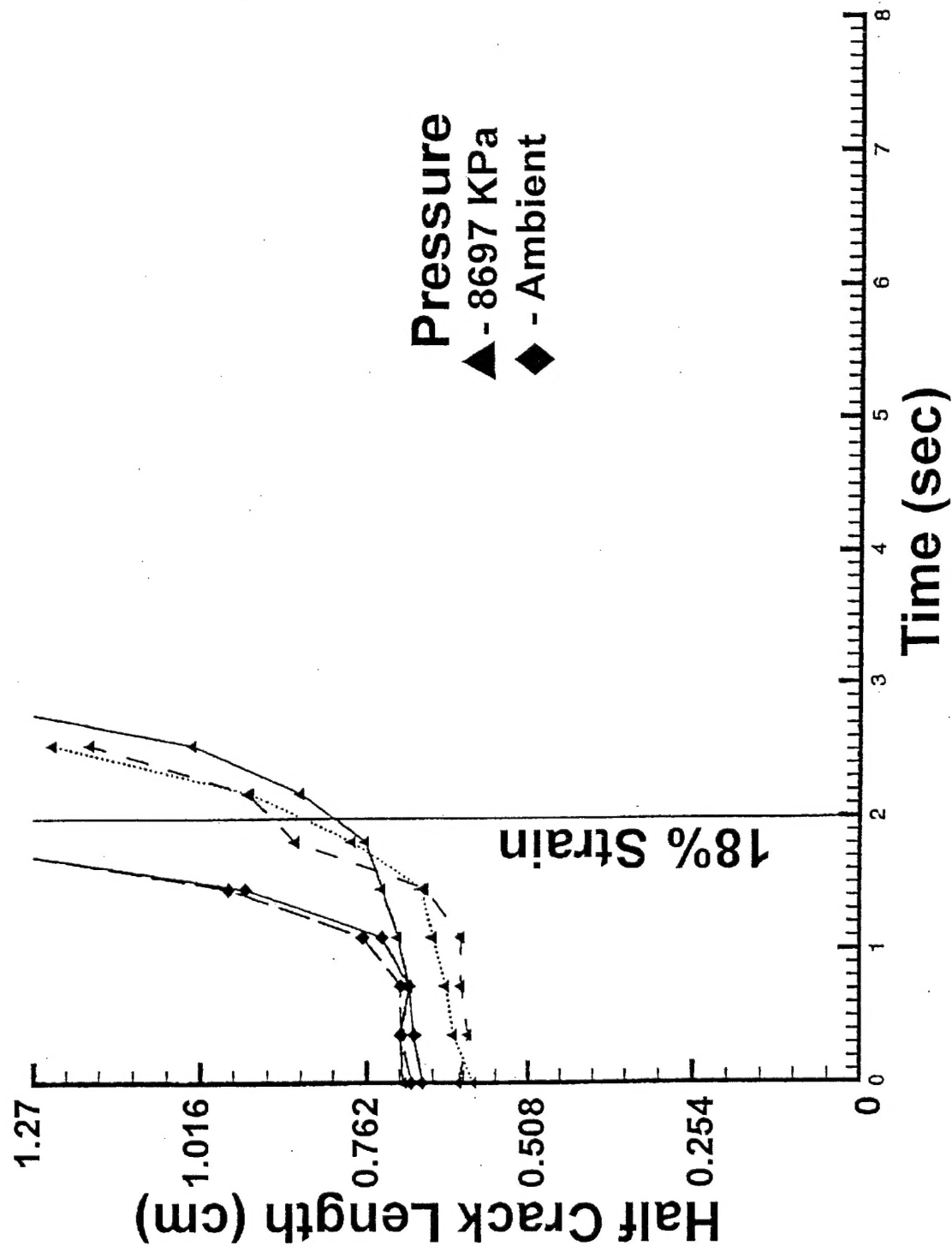
ambient pressure

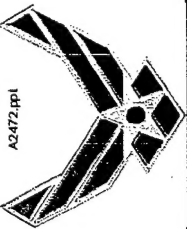


8697 Kpa confining pressure

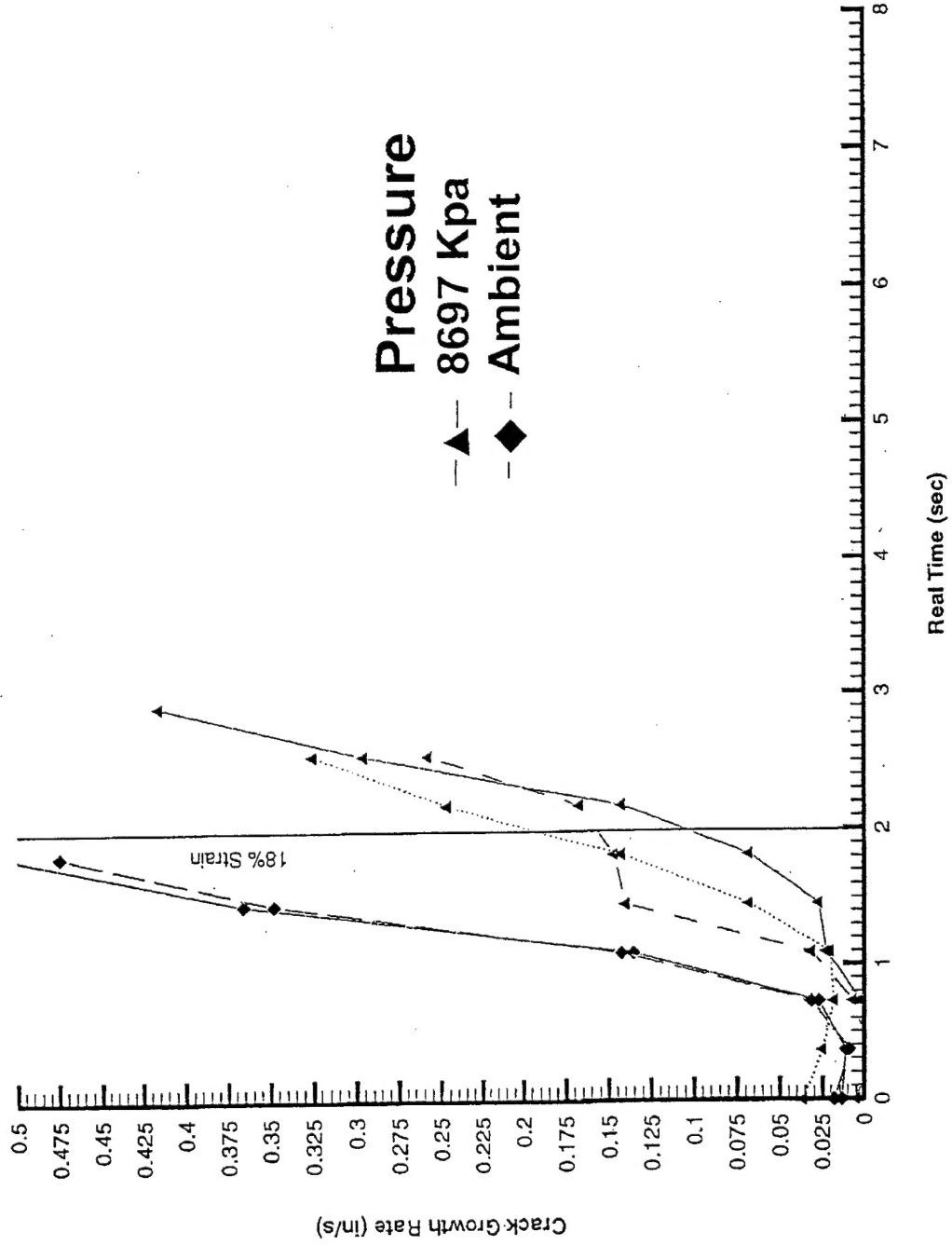


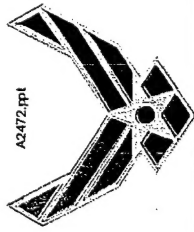
# Half Crack Length Vs. Time (Constant Strain Rate Condition)



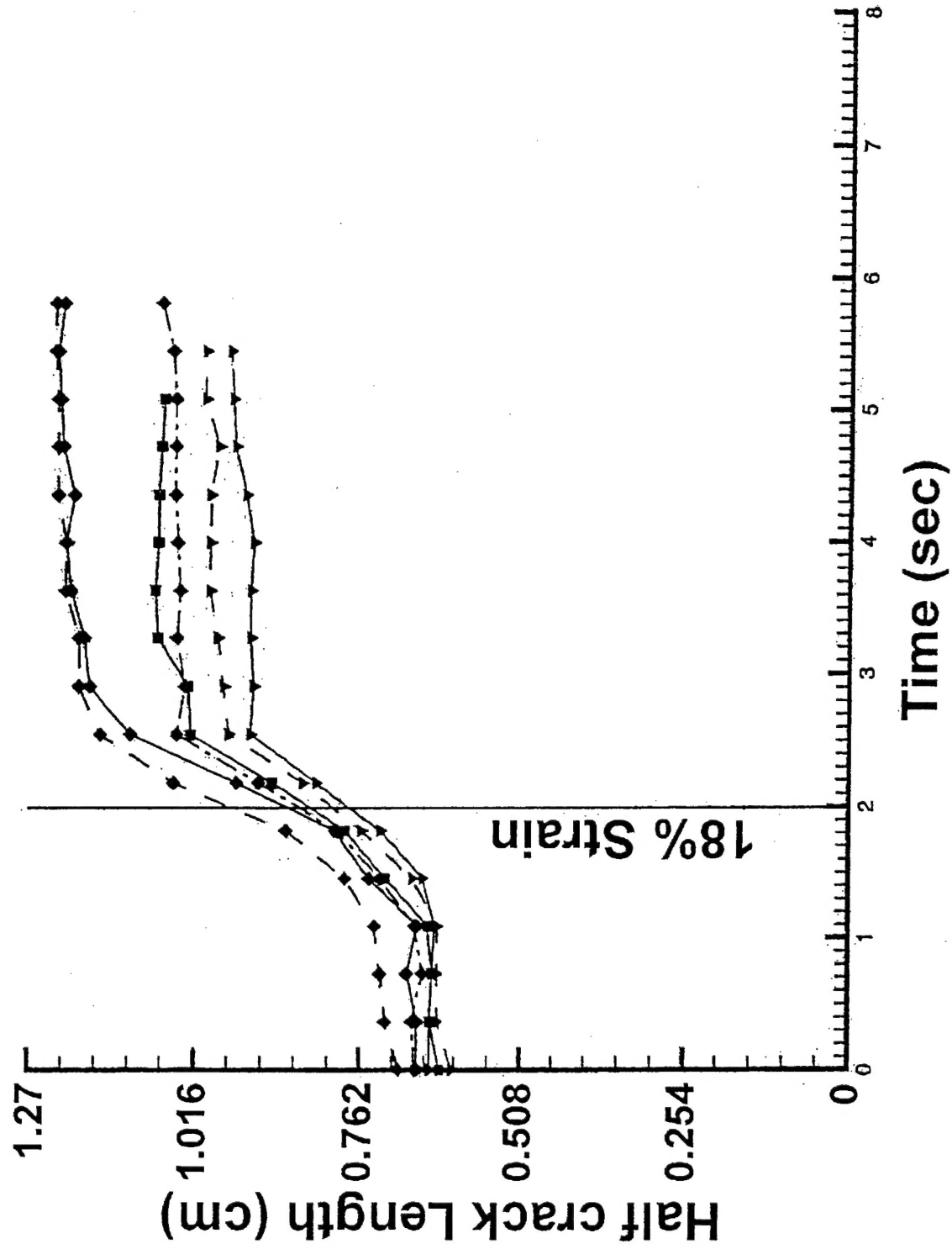


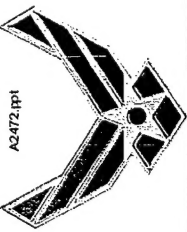
# Crack Growth Rate Vs. Time (Constant Strain Rate Condition)



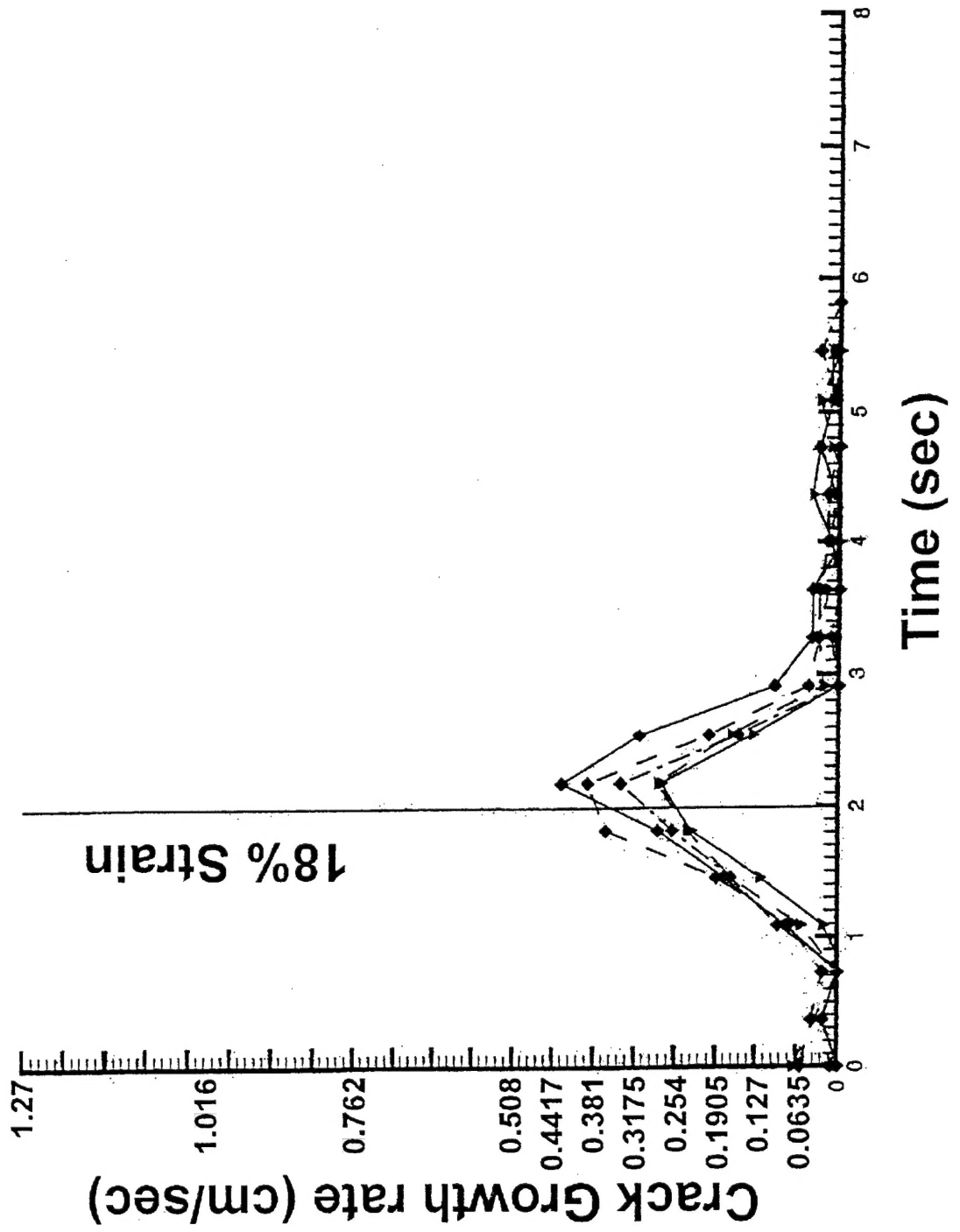


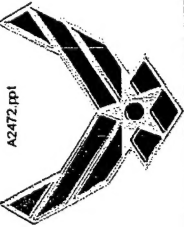
# Half Crack Length Vs. Time (Constant Strain Condition)





# Crack Growth Rate Vs. Time (Constant Strain Condition)





# Conclusions



- The crack growth rate under ambient pressure is significantly higher than that under 8697 KPa confining pressure.
- At the onset of crack growth, the crack opening displacement under 8697 KPa confining pressure is greater than that under ambient pressure.
- At the onset of crack growth, confining pressure has no significant effect on the size of the high-strain zone.
- Under constant strain condition, the crack stops growing after it propagates a short distance.